



Idaho's Core Competencies

A report by:
Governor's Science & Technology Advisory Council
Subcommittee

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Idaho's Core Competencies

Imaging
Power/Energy
Ag BioSciences
Nano Science and Materials

Overview

Idaho industries have honed expertise in specific areas, but this expertise isn't limited to existing industry segments.

Other industries, even those seemingly unrelated at first glance, could benefit by the tremendous skill sets and knowledge workers already in Idaho.

"Clustering" is a phenomenon where firms in related industries tend to concentrate geographically and take advantage of regional expertise. (Think of Detroit, home not only to top automakers, but parts manufacturers, suppliers and electronics components designers.)

Industry, INEEL and university members teamed up to identify the core competencies that now exist in Idaho. Initially, these areas were identified:

Bioscience
Computer Science
Geoscience
Materials Science
Electrical Engineering
Mechanical Engineering

Once identified, it was quickly evident that there were cross-over competencies. (See chart, appended) Electrical engineering, for instance, had applications here for a broader category called Imaging as well as in a Power/Energy segment, and Ag/BioSciences. Because of this, the initial six competencies were further honed into four categories that best describe Idaho's expertise in technology.

Idaho's expertise can be used by a variety of industries and in a number of ways. This brief provides an overview of the resource strengths and technical knowledge already established. It also provides a glimpse at some additional industry segments that could take advantage of Idaho's existing technology strengths.

Recommendations

During the course of the subcommittee's work on core competencies, a number of recommendations and suggestions were captured that the subcommittee felt would accelerate the State's success.

The subcommittee felt it was important to capture these for consideration by the Governor's Science & Technology Council and the Office of Science & Technology.

1. Build an IT infrastructure to enable/foster collaboration and innovation between universities, labs and industry within the state of Idaho.
2. Implement statewide coordination of IP (intellectual property) processes in our universities. Create a common and leveraged tech transfer program across the universities.
3. Create a jointly funded (public and private), privately run, incubation, or innovation center. This would be a bricks and mortar version of number 1 (above).
4. Match advanced degree programs and hiring of key professors in the technology platform areas.
5. Initiate formation of free standing, joint, Science and Tech Committee within Idaho House/Senate.
6. Department of Commerce to develop targeted programs to attract companies in the identified technology platform areas to Idaho.
7. Build IP councils in each technology platform area

Core competencies, areas of focus

Opportunities and areas of interest

1. Imaging

Definition: The capture, reproduction, rendering, and/or analysis of images, image sequences (video), photographs, documents.

What that means and related industries: Printing, copying, digital photography, medical equipment, home entertainment systems, monitoring devices used in a variety of industries including agriculture, medical, security and defense.

Examples of Idaho's imaging technology

Copying/printing - Hewlett-Packard Co. does research and development, product development and integration technologies, ASIC chip design for controllers, software and firmware design for this market segment. End products that result from this expertise include copiers, printers, scanners, multi-function printers, and digital cameras.

Potential future opportunities: Companies or industries connected to digital camera devices, components or digital cameras themselves. Other copying/printing firms.

Digital photography – Micron Technology makes imaging chips and memory that is used in digital cameras. HP does R&D functions for this area.

Potential future opportunities: Companies dealing with all areas of printers, digital cameras, photofinishing and components for both personal and professional products.

Pattern recognition – HP specializes in this area that allows it to implement counterfeiting detection systems (for instance).

Potential future opportunities: Agriculture for remote sensing, medical equipment makers or developers, and components/devices for these areas; homeland security development, and defense industries.

Image/document segmentation and decomposition – Firms such as HP and Agilent here work with this technology that can separate text from images on a single document for further manipulation.

Potential future opportunities: printer and copier vendors, related industries.

Image analysis /enhancement – Firms in Idaho develop components and software in this area of expertise. Micron, for instance, makes hardware and software for achieving true to life image quality.

Potential future opportunities: Other software, components; medical devices and components; digital photography; printing devices and components.

Image compression/decompression and video compression/decompression – Firms here develop this technology to compress documents to save space and memory, and spur better faster performance of devices (PDAs, computers, video streaming). Micron, for instance, makes hardware and software for compressing and decompressing images.

Potential future opportunities: Entertainment systems applications, photography, computer applications, electronic storage.

Digital document management – Expertise is here to develop these systems that can route scanned forms automatically to storage or archives.

Potential future opportunities: Software, printing industry; technology widely used across most industries

Earth surface and subsurface imaging – Research and development efforts at INEEL and the Idaho universities, and implementation by companies such as GeoEngineers (office in Boise) and North Wind (Idaho Falls) and others is underway to greatly improve our ability to image, characterize and monitor the Earth's surface and subsurface for resource utilization and ecosystem management applications. New technology will provide a better understanding of the phenomena occurring below the surface of the Earth, how contaminants behave in the environment, how to better manage our ground water resources and where to locate valuable mineral deposits.

Potential future opportunities: A variety of industries, from agriculture to food production, resource management, environmental remediation and waste management, to instrument and electronic devices and components. Applications and opportunities will also exist in the mining industry and for land use and resource utilization planners and managers.

Home entertainment – Micron makes memory that ends up in gaming devices, toys and a variety of home electronics; new firm Dedicated Devices makes a whole-house connectivity system; HP develops variety of related products

Potential future opportunities: Electronics memory, chip design, custom chip manufacturing, expertise in electronics used in imaging and applications.

Microscopy – Companies doing imaging technology use various technique for imaging below the optical limit. Expertise is here in Idaho in using microscopy techniques such as SEM (scanning electron microscope), TEM (transmission electron microscope), or AFM (atomic force microscope). This expertise is used within the manufacturing process of anything at the nano level.

Potential future opportunities: This expertise can be used in any industry that focuses on imaging. Development and manufacture of SEMs, TEMs, AFMs or any other of these types of microscopes.

2. Power/energy

Definition: Pursuit of dependable, affordable and environmentally sound production and distribution of energy for the future

What that means and related industries: Areas of focus include resource availability and sustainability, environmental and national security, and research in how environmentally sustainable energy sources (including nuclear energy) can mitigate climate change, and improve water utilization.

Examples of Idaho's power/energy work

Bioenergy production – The INEEL and several industry partners are working with state agencies and large farm operations in Idaho to convert crop residue to alcohol and thus into fuel. The work involves redesigning combines and harvesting techniques to collect and separate usable biomass materials while dropping rich nutrient materials back onto the field. Twin Falls firm, Intrepid, is using a cow manure digester that captures and purifies methane for fuel applications running from natural gas powered vehicles to powering home and industry.

Potential future opportunities: The technology is applicable to any livestock operation, including dairies and feedlots; heavy equipment manufacturers, agriculture, chemical companies, fuel transportation and distribution services, food industries, and energy supply companies.

Hydrogen production – Idaho companies such as Idaho Power (subsidiary IdaTech) and INEEL are looking at new ways to produce hydrogen for transportation applications and energy production. One new technology being developed by the INEEL and industrial partners has interest by the U.S. Navy, for production of shipboard electricity and remote synthesis of various fuel compounds.

Potential future opportunities: Companies making fuel cells, companies producing hydrogen, firms making equipment and infrastructure to distribute hydrogen; new energy industry partners working on alternative power sources.

Advanced battery systems – R&D projects underway with INEEL to create new systems and technologies to make batteries last longer and be more efficient.

Potential future opportunities: Companies that make energy storage systems; component makers.

Advanced fossil energy systems and carbon sequestration – INEEL and partners are conducting advanced research to develop better ways to contain CO₂ emissions from coal or fossil fuel power plants to reduce greenhouse gas impacts.

Potential future opportunities: Manufacturers and designers of advanced fossil energy systems and equipment, energy producers and utilities as well as manufacturers of new materials of construction.

3. Ag BioSciences

Definition: The research, development and management of biologically based organisms and their ecosystems.

What that means and related industry: Idaho's strong agriculture industry, studies relating to the area's ecosystems, and related research has created a robust expertise in the state.

Examples of Idaho's Ag BioSciences work:

Genetics of plants, seeds and animals: Whether it's cloning research at University of Idaho or research at the Agriculture Extension Systems many laboratories in the state, there is a core expertise that ranges from husbandry to producing new seed varieties. Idaho has also become the research grounds for several large national seed companies that are developing new seed products.

Potential future opportunities: Attraction of additional seed, plant and vegetable companies; firms doing research and development of plant-made pharmaceuticals.

Infectious disease in plants, animals and humans: Currently research at a number of research labs in the state into controlling harmful bacteria and promoting useful bacteria, wildlife disease management, and infectious disease in fish.

Potential future opportunities: Expertise in these areas has potential to attract industry partners in using bacteriology to manufacture pharmaceutical products; environmental cleanup industry using bacteriology; and further research in these areas.

Management of ecological systems (water and natural environments): Currently programs at all universities and INEEL from site clean up to understanding of hydrology and watershed systems; studies into microorganism found in extreme environments with their uses being developed.

Potential future opportunities: Managing water systems in other areas/countries; more aquaculture studies and industry; opportunity to export expertise.

Food safety technology: Simplot and other food producers already doing work in this area, and universities are doing research into food safety. Students being produced with specialties in food safety.

Potential future opportunities: Food producers industry; bolstering and support of current agriculture industry

Biomaterials: New materials and organisms derived from Idaho's natural environment; BSU laboratories doing research in this area that allows the manipulation and growth of biomaterials such as human cartilage.

Potential future opportunities: Establishing new biotech companies that would work with new materials; Potential to attract new venture capital focused on this area and bioscience companies.

Bioinformatics: An emerging competency for the state, with research at universities and INEEL on ways to process technical and scientific data efficiently. This type of computing emulates the brain.

Potential future opportunities: Companies built around bioinformatics that have developed new approaches to modeling.

4. Nano Science & Materials

Definition: Research, development, manufacture and analysis of materials with features between 100 nanometers and $1/10^{\text{th}}$ of a nanometer in size. In this science, manipulating materials near the atomic/molecular level is critical to the material's purpose.

What that means and related industry: Nanotechnology will impact almost every industry because the ability to manipulate materials at the nano level has the potential to improve almost every aspect of materials used in electronics, biology, construction, and essentially every other field. In the semiconductor field, most new products and research are being done at the nano level.

Examples of Idaho's Nano Science & Materials work:

Nano electronics: Semiconductors today, such as memory and imaging devices made by Micron Technology and other semiconductor firms, are increasingly manufactured at the nano level. Designs and manufacturing techniques must account for, if not directly influence, nano-size effects.

Potential future opportunities: Almost every semiconductor firm today is using this new area of expertise.

Nano Micro Electro Mechanical Systems (NEMS) – As these devices shrink into the nano regime, the field of NEMS is emerging with research going on here. NEMS, for example, are tiny machines that are used in accelerometers in most cars today that trigger airbags. That technology uses MEMS, or micro electro mechanical systems, that are made on silicon chips.

Potential future opportunities: Research in this area is emerging in a number of industries.

Nano Mechanics: Idaho company NanoSteel, a spinoff of INEEL technology, is using nanotechnology to make a superhard coating.

Potential future opportunities: Almost unlimited, because this technology and expertise can be used in manipulating any material at the atomic/molecular level to create superior products.

Nano Biotech: Research is ongoing at manipulating molecules in biological systems.

Potential future opportunities: Would be of interest to those who create pharmaceuticals and drug delivery systems and even more effective fertilizers.

NDE/NDA Technologies – These non-destructive technologies allow for imaging below the surface of materials without damaging the structure to detect cracks and flaws. INEEL spinoff Positron Systems uses this technology and is working with several federal agencies on related projects to create a safer infrastructure in the United States.

Potential future opportunities: Research and manufacturing by various firms that develop products or components used in everything from the space shuttle to jet engines.



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